








New records of two teleost species from two insular areas of the western equatorial Atlantic

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Abstract

We report the first record of two teleost species from two archipelagos in the western equatorial Atlantic. We recorded the occurrence of *Cantherhines pullus* (Ranzani, 1842) (Monacanthidae, Tetraodontiformes) from the Fernando de Noronha Archipelago, a group of volcanic islands 345 km off the northeastern coast of Brazil. We also report the first regional record of *Hemiramphus brasiliensis* (Linnaeus, 1758) (Hemiramphidae, Beloniformes) from the Saint Peter and Saint Paul's Archipelago, which is a small and isolated group of rocky islands 520 km from the Fernando de Noronha Archipelago on the Mid-Atlantic Ridge.

Keywords

Brazil, Fernando de Noronha Archipelago; ichthyofauna; Saint Peter and Saint Paul's Archipelago

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Introduction

The inventory of the ichthyofauna of oceanic island environments is of considerable importance in various fields of knowledge, including evolution and biogeography, and has direct relevance to conservation (Pinheiro et al. 2018). Insular environments are known to have a high rate of endemism, as certain evolutionary processes, such as inbreeding and loss of genetic variability, are more pronounced in limited populations disconnected from the continental environments (Roberts et al. 2002; Rocha 2003).

The Fernando de Noronha Archipelago (FNA) comprises an isolated group of volcanic islands located in the western equatorial Atlantic Ocean, ~350 km off the northeastern coast of Brazil (03°50'S, 032°25'W; Fig. 1). This insular region is under the influence of the South Equatorial Current, with an average water surface temperature of 26 °C and a tropical oceanic climate characterized by a rainy season during February–July and a dry season during the rest of the year (Maida and Ferreira 1997).

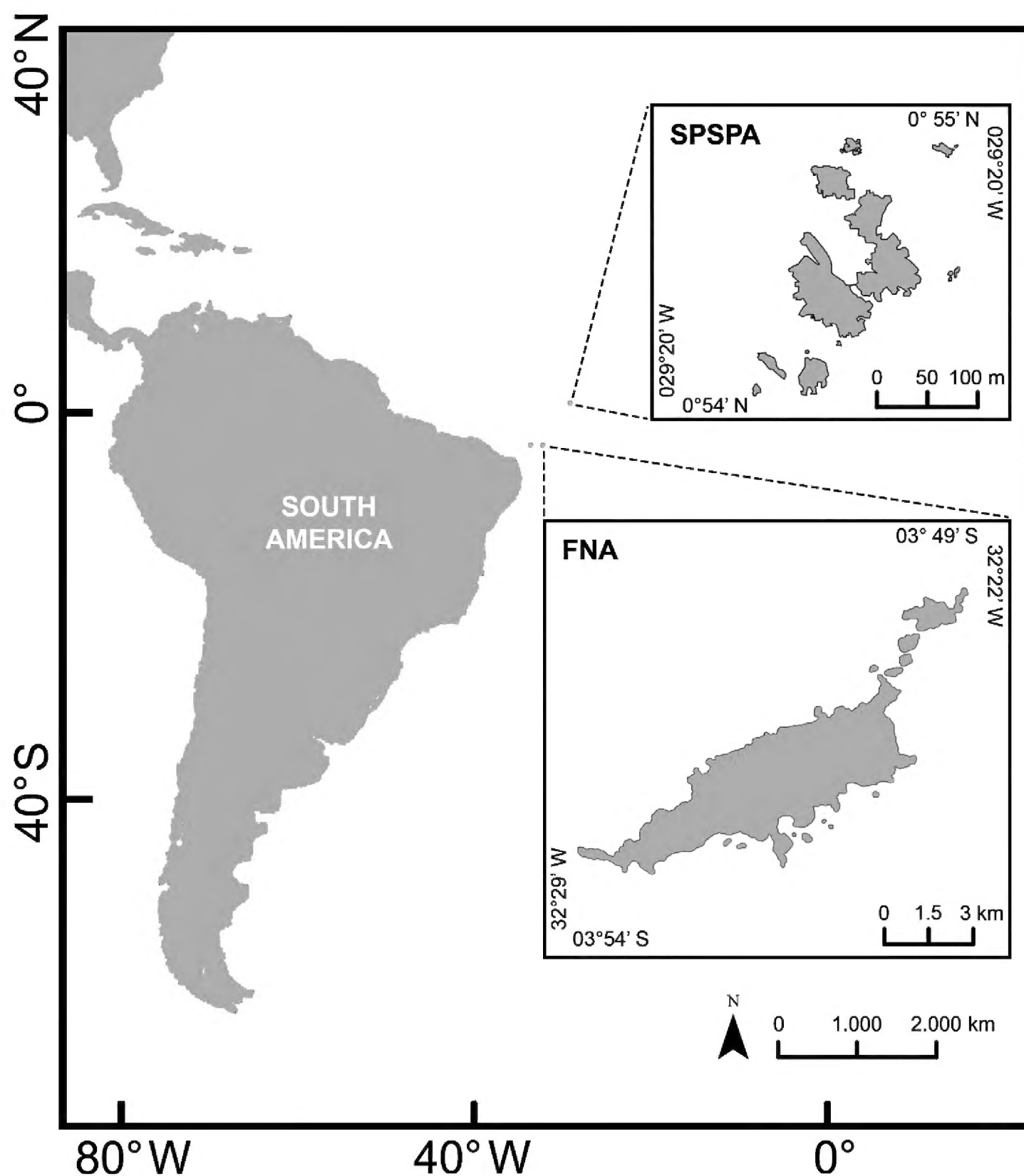


Figure 1. Geographical location of Fernando de Noronha Archipelago (FNA) and Saint Peter and Saint Paul's Archipelago (SPSPA) in the western equatorial Atlantic.

Most of the area around the FNA constitutes a marine national park where fishing is prohibited and tourist activities are regulated (Brasil 1988; Ibama 1990). The remaining area of the archipelago falls under the Fernando de Noronha Environmental Protection Area – Rocas – São Pedro and São Paulo, where fishing, land occupation, and tourist activities are allowed (Brasil 1986; ICMBio 2017).

The Saint Peter and Saint Paul's Archipelago (SPSPA) consists of 10 small rocky islets in Brazilian territorial waters and are located on the Mid-Atlantic Ridge ($00^{\circ}55'01''\text{N}$, $029^{\circ}20'76''\text{W}$; Fig. 1), ~1100 km from the northeastern coast of Brazil. The SPSPA is under the influence of the South Equatorial Current that flows westwards and the Equatorial Countercurrent that flows eastwards at a depth of 40–150 m (Edwards and Lubbock 1983).

In 2018, the Brazilian government declared the SPSPA an Environmental Protection Area, where fishing and the use of natural resources are permitted over 407,052 km² around the archipelago. SPSPA was also given the status as a marine natural marine monument,

an integral protection area with 47,263 km² of territorial sea (Brasil 2018).

The ichthyofauna of island environments is dynamic, undergoing colonization and extinction events over time (Mellin et al. 2010). Additionally, knowledge about the species diversity of remote oceanic islands is often incomplete, primarily due to difficulties in access and the inherent limitations of collection methods. The high degree of endemism of reef fish (Edwards and Lubbock 1983; Rocha 2003; Floeter et al. 2008; Hachich et al. 2015; Macieira et al. 2015; Pinheiro et al. 2018; Pimentel et al. 2020; Pinheiro et al. 2020), the presence of divergent genetic lineages (Rocha et al. 2005; Neves et al. 2016; Anderson et al. 2017), unusual behaviors (Luiz 2005; Gasparini et al. 2008), and the existence of populations with specific color morphs (Feitoza et al. 2003; Luiz 2003) reinforce the need for a more accurate investigation of the fish diversity in such locations.

The most complete and up-to-date information on ichthyofauna for the FNA reported the occurrence of 250 species (Pimentel et al. 2020), while for SPSPA, 225 species have been reported (Pinheiro et al. 2020). The

present study adds two unreported fish to the species inventories for these archipelagos, providing data for a better assessment of the biogeographic patterns of the oceanic islands of the western equatorial Atlantic.

Method

Specimens were collected with permission from the Chico Mendes Institute for Biodiversity Conservation (ICMBio 19135-8). The specimens were collected with a hand net, fixed in 10% formalin, transferred to 70% ethanol, and deposited in the fish collection of the Fisheries Biology Laboratory of the Federal University of Rio Grande do Norte (LABIPE). Morphometric measurements were performed using digital calipers with 1mm precision and the weight was measured with an electronic scale to the nearest 1 g. The individuals were identified, based on meristic and morphometric characters, following the diagnosis proposed by Berry and Voegelé (1961) and McEachran and Feckhelm (1998).

Results

Cantherhines pullus (Ranzani, 1842)

Orangespotted Filefish

Figure 2

New record. BRAZIL • PE, Fernando de Noronha Archipelago, Praia do Sancho; 03°51'07"S, 032°26'38"W, depth of ~2 m from a rock bottom; 26.I.2018; R.X.

Soares, A.T. Borges and K.D.J. Amorim leg.; hand net; LABIPE 1257.

Identification. The individual was identified based on meristic and morphometric characteristics (Table 1) described in the diagnostic key by Berry and Voegelé (1961) (Table 1).

Hemiramphus brasiliensis (Linnaeus, 1758)

Ballyhoo Halfbeak

Figure 3

New record. BRAZIL • Saint Peter and Saint Paul's Archipelago; 00°56'N, 029°18'W, ~5.5 km northeast of the main rocky islets of SPSPA; 13.I.2018; R.X. Soares, A.T. Borges and K.D.J. Amorim leg.; hand net; LABIPE 1256.

Identification. The individual was identified based on the diagnosis proposed by McEachran and Feckhelm (1998) after the confirming the meristic and morphometric characters (Table 1).

Discussion

The existence of an ichthyofaunal species shared between both sides of the Atlantic and the SPSPA is likely a result of the dispersal, colonization, and larval settlement capacity of some species (Feitoza et al. 2003).

The documented distribution of *C. pullus* covers the East Atlantic from the Gulf of Guinea (Carpenter and De Angelis 2016a), including the islands of São Tomé and Príncipe (Wirtz et al 2007) and in the Western

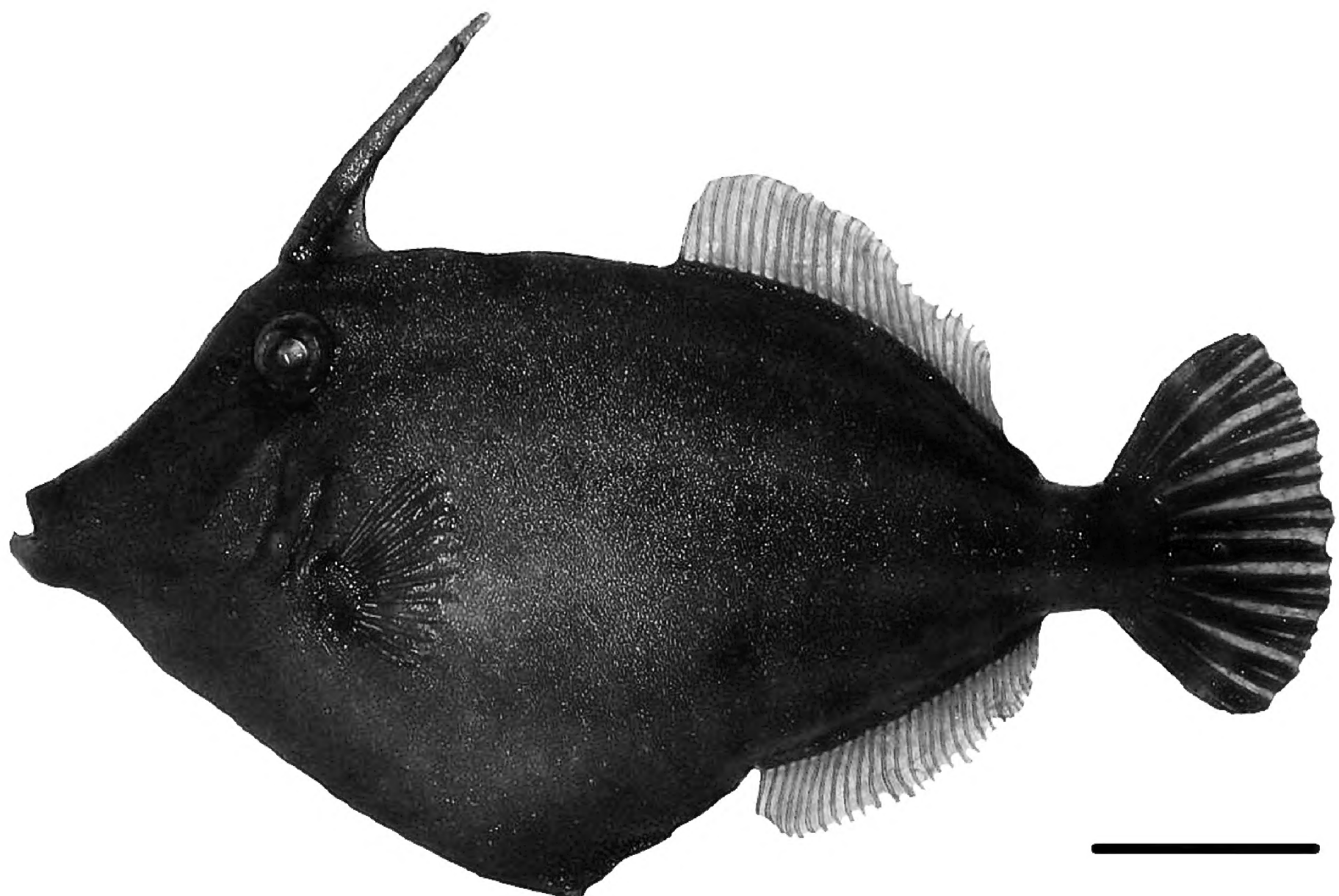


Figure 2. *Cantherhines pullus*, LABIPE-1257, 141.8 mm SL. Scale bar = 30 mm.

Table 1. Morphometric and meristic characteristics of *Cantherhines pullus* and *Hemiramphus brasiliensis* specimens deposited in the fish collection of the LABIPE.

<i>Cantherhines pullus</i>	
Morphometric (mm)	LABIPE 1257
Total length	168
Standard length	141.8
Head length	43.2
Snout length	31.2
Pectoral length	15.9
Body depth	73.1
Eye diameter	10.5
Eye to dorsal spine distance	9.3
Meristic	
Dorsal rays	33
Anal rays	29
Pectoral rays	13
Weight (g)	95

<i>Hemiramphus brasiliensis</i>	
Morphometric (mm)	LABIPE 1256
Total length*	245.8
Standard length*	181.4
Distance between pectoral insertion to pelvic insertion	76.6
Distance between pelvic insertion to caudal base	57.1
Pectoral length	30.7
Body depth at pectoral origin	24.8
Body depth at pectoral tip	28
Meristic	
Dorsal rays	14
Anal rays	13
Pectoral rays	10
Pelvic rays	6
Caudal rays	20
Gill rakers	12+18
Weight (g)	102

* Beak partially broken

Atlantic from Massachusetts (USA), Gulf of Mexico and Caribbean Sea, to the Laje de Santos marine park, on the coast of the state of São Paulo in the southeastern Brazil (Menezes et al. 2007; Luiz et al. 2008; Fricke et al. 2021), including the Trindade and Martin Vaz Archipelago (Pereira-Filho et al. 2011). The occurrence of *C. pullus* in Bermuda (Carpenter 2002) and in the Trindade and Martin Vaz Archipelago represent the dispersive capacity of the species throughout its geographic distribution in remote island habitats. This may explain the extensive distribution of *C. pullus*, with certain oceanic islands serving as favorable habitats for settlement and

connectivity between the two sides of the Atlantic.

Hemiramphus brasiliensis is distributed in the Eastern Atlantic from Mauritania to Luanda (Angola), including the Cape Verde Islands (Carpenter and De Angelis 2016b). In the Western Atlantic, it is recorded from Massachusetts (USA), Gulf of Mexico, and Caribbean Sea to southeastern Brazil (Menezes et al. 2007; Fricke et al. 2021), including the FNA (Soto 2001) and the Trindade Archipelago and Martin Vaz (Gasparini and Floeter 2001). The occurrence of *H. brasiliensis* in the SPSPA, located ~1100 km from the northeast coast of Brazil and ~1700 km from the Cape Verde Islands, reinforce the role of this region as a support point to some amphi-Atlantic species.

Despite the common occurrence of endemic species (*Bodianus insularis* Eschmeyer, 1971, *Herpetoichthys regius* (Richardson, 1848), *Pontinus nigropunctatus* (Günther, 1868), *Scorpaenodes insularis* Eschmeyer, 1971) among Ascension Island, Saint Helena, and the SPSPA suggest a faunal link between these archipelagos, *H. brasiliensis* is reported exclusively for the last mid-Atlantic insular region (Wirtz et al. 2017; Brown et al. 2019). Thus, the consistent increase in the number of species recorded over time in the FNA and SPSPA demonstrates their biogeographic importance as stepping-stone habitats for some Atlantic fish species, and emphasizes the conservation importance of these island areas.

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Authors’ Contributions

Conceptualization: RXS, JGJ. Data curation: JGJ. Formal analysis: ATB, JGJ. Funding acquisition: WFM. Investigation: RXS, KDJA, ATB. Methodology: RXS, KDJA. Project administration: WFM. Visualization: RXS, JGJ. Writing – original draft: RXS, KDJA, WFM, JGJ. Writing – review and editing: ATB, WFM, JGJ.



Figure 3. *Hemiramphus brasiliensis*, LABIPE-1256, 181.4 mm SL. Scale bar = 30mm.

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